MONROE TABLE OF DIVIDING FACTORS FOR SQUARE ROOTS

The Monroe Table of Dividing Factors for securing roots gives accuracy to five significant figures. However, in some cases there may be an error of one in the fifth significant figure due to adjusting the final figures in calculating the factors.

INSTRUCTIONS

Odd and Even Factors

For roots of whole numbers and mixed numbers

When the number of whole number digits is ODD, use the factor in ODD (black figures) column.

When the number of whole number digits is EVEN, use the factor in EVEN (green figures) column.

For roots of decimal numbers

When the number of zeros preceding the first significant figure is ODD, use the factor in ODD column.

When the number of zeros preceding the first significant figure is EVEN, use the factor in EVEN column.

When no zeros precede the first significant figure, use the factor in EVEN column.

Monroe Method

This method can be used on any model of the Monroe Adding-Calculator.

Set the number, the root of which is to be found, on the keyboard of the Monroe and register it in the lower dials.

In the NUMBER column find the number nearest to the first three left-hand significant figures of the number the root of which is being found. Set this value on the keyboard and add it to the number already in the lower dials of the machine, being sure the left-hand figures are in alignment.

By inspection determine, according to the explanation above, whether the factor in the ODD or EVEN column should be used. Select the factor corresponding to the NUMBER value, set it on the keyboard and divide. The result in the upper dials of the Monroe is the root of the number to five significant places.

Pointing Off Decimals in Roots

Roots of whole numbers and numbers with decimals

Starting at the decimal point in the number the root of which has been found and working to the left, set off the number into groups of two figures each. The number of such two-figure groups will be the number of whole numbers in the root. If the extreme left-hand group consists of only one figure it should be counted as though a complete group.

Roots of decimal numbers

Starting at the decimal point in the number the root of which has been found and working to the right, set off the zeros preceding the first significant figure into groups of two zeros each. The number of such groups will be the number of zeros that should precede the first significant figure in the root. If the last right-hand group consists of only one zero it should NOT be counted as a group. If no zero, or only one, precedes the first significant figure in the decimal number, then no zeros should precede the first significant figure of its root and the decimal point is placed before the first figure.

Example I

$\sqrt{6942.3214} = ?$

With the machine clear, shift the carriage of the Monroe to the fifth position. Set 69423214 on the extreme left-hand side of the keyboard and register in the lower dials by depressing the plus bar once. Clear keyboard.

Referring to the NUMBER column, 693 is the number nearest to the first left-hand three significant figures of the number whose root is to be found. Set the 693 on the extreme left-hand side of the keyboard in line with the 694 in the lower dials and depress the plus bar once. Clear upper dials and keyboard.

The factor in the EVEN (green) column of the table for 693 is 1664932. Set this on the extreme left of the keyboard. Divide. The answer in the upper dials, 83320 or 83.320, is the root. The decimal point in the root is found by setting off the number 6942.3214 into groups of two figures each, 69'42'.3214. Since there are two groups of two figures, according to the rule there should be two whole numbers in the root, thus 83.320.

Example II

$\sqrt{.000003912} = ?$

With the carriage in the fifth position, set 3912 on the extreme left of the keyboard. Depress plus bar once. Clear keyboard.

Referring to the NUMBER column of the table, set 390 on the extreme left of the keyboard. Depress plus bar once. Clear upper dials.

Set 3949684, from the ODD column of the factor table, on the extreme left of the keyboard. Divide. The answer in the upper dials is 19778 or .0019778, the root. The decimal point is found by setting off .000003912 into groups of two zeros each starting at the decimal point and working to the right, .00'00'03'912. As there are two groups of two zeros each preceding the first significant figure, two zeros should precede the first significant figure of the root, thus .0019778.

Example III

$\sqrt{730.6789} = ?$ Root required to nine significant figures

A Monroe model with ten columns on the keyboard is required to secure the root to nine places.

With the carriage in the fifth position, set 7306789 on the extreme left of the keyboard. Depress plus bar once. Clear keyboard.

Referring to the NUMBER column of the table, set 729 on the extreme left of the keyboard. Depress plus bar once. Clear upper dials.

Set 5400000 from the ODD column of the factor table, on the extreme left of the keyboard. Divide. The answer in the upper dials, 27031, which when pointed off is 27.031, the root to five figures. Up to this point a Monroe with an eight column keyboard can be used. To secure the root to nine significant figures and using a ten column model, proceed from this point as follows:

Clear machine and shift carriage to tenth position. Set 7306789 on the extreme left of the keyboard. Depress plus bar once. Clear upper dials and keyboard.

Set 27031 (root secured above) on the extreme left of the keyboard. Divide. Copy 2703114572 from the upper dials to the keyboard. Clear both upper and lower dials.

By depressing the plus bar register 2703114572 in the lower dials. Set the root, 27031, on the extreme left of the keyboard and depress plus bar once. Clear keyboard and upper dials. Set 2 on the extreme right of the keyboard. Shift carriage to tenth position and divide. The answer in the upper dials, 2703107286, which when pointed off is 27.0310729, the root.

Following this method an eight column Monroe can be used to find the root to eight places.

MONROE TABLE OF
DIVIDING FACTORS FOR SQUARE ROOTS

For accuracy of five significant figures in roots. See reverse for explanation and instructions.

NUM-BER	ODD	EVEN	NUM-BER	ODD	EVEN	NUM-BER	ODD	EVEN
101	200 9975	635 6099	236	307 2458	971 5966	510	451 6636	142 8286
103	202 9778	641 8723	240	309 8387	979 7959	517	454 7527	143 8054
105	204 9390	648 0741	244	312 4100	987 9271	524	457 8209	144 7757
107	206 8816	654 2171	248	314 9603	995 9920	531	460 8687	145 7395
109	208 8061	660 3030	252	317 4902	100 3992	538	463 8965	146 6970
111	210 7131	666 3332	256	320 0000	101 1929	545	466 9047	147 6482
113	212 6029	672 3095	260	322 4903	101 9803	552	469 8936	148 5934
115	214 4761	678 2330	264	324 9615	102 7619	559	472 8636	149 5326
117	216 3331	684 1053	268	327 4141	103 5374	566	475 8151	150 4659
119	218 1742	689 9275	272	329 8484	104 3072	573	478 7484	151 3935
121	220 0000	695 7011	276	332 2650	105 0714	580	481 6638	152 3155
123	221 8107	701 4271	280	334 6640	105 8301	588	484 9742	153 3623
125	223 6068	707 1068	284	337 0460	106 5833	596	488 2622	154 4021
127	225 3886	712 7412	288	339 4113	107 3313	604	491 5282	155 4349
129	227 1563	718 3314	292	341 7601	108 0740	612	494 7727	156 4609
131	228 9105	723 8784	296	344 0930	108 8118	620	497 9960	157 4802
133	230 6513	729 3833	300	346 4102	109 5445	628	501 1986	158 4929
135	232 3790	734 8469	304	348 7119	110 2724	636	504 3808	159 4992
137	234 0940	740 2702	308	350 9986	110 9955	644	507 5431	160 4992
139	235 7965	745 6541	312	353 2704	111 7139	652	510 6858	161 4930
141	237 4868	750 9993	316	355 5278	112 4278	660	513 8093	162 4808
143	239 1652	756 3068	320	357 7709	113 1371	668	516 9139	163 4625
145	240 8319	761 5773	325	360 5551	114 0175	676	520 0000	164 4384
147	242 4871	766 8116	330	363 3180	114 8913	684	523 0679	165 4086
149	244 1311	772 0104	335	366 0601	115 7584	693	526 4979	166 4932
151	245 7641	777 1744	340	368 7818	116 6190	702	529 9057	167 5709
153	247 3863	782 3043	345	371 4835	117 4734	711	533 2917	168 6416
155	248 9980	787 4008	350	374 1657	118 3216	720	536 6563	169 7056
157	250 5993	792 4645	355	376 8289	119 1638	729	540 0000	170 7630
159	252 1904	797 4961	360	379 4733	120 0000	738	543 3231	171 8139
161	253 7716	802 4961	365	382 0995	120 8305	747	546 6260	172 8583
164	256 1250	809 9383	370	384 7077	121 6553	756	549 9091	173 8965
167	258 4570	817 3127	375	387 2983	122 4745	765	553 1727	174 9286
170	260 7681	824 6211	380	389 8718	123 2883	774	556 4171	175 9545
173	263 0589	831 8654	385	392 4283	124 0967	783	559 6427	176 9746
176	265 3300	839 0471	390	394 9684	124 9000	792	562 8499	177 9888
179	267 5818	846 1678	395	397 4921	125 6981	802	566 3921	179 1089
182	269 8148	853 2292	400	400 0000	126 4911	812	569 9123	180 2221
185	272 0294	860 2325	406	402 9888	127 4363	822	573 4108	181 3284
188	274 2262	867 1793	412	405 9557	128 3745	832	576 8882	182 4281
191	276 4055	874 0709	418	408 9010	129 3058	842	580 3447	183 5211
194	278 5678	880 9086	424	411 8252	130 2306	852	583 7808	184 6077
197	280 7134	887 6936	430	414 7288	131 1488	862	587 1967	185 6879
200	282 8427	894 4272	436	417 6123	132 0606	872	590 5929	186 7619
203	284 9561	901 1104	442	420 4759	132 9662	882	593 9697	187 8297
206	287 0540	907 7445	448	423 3202	133 8656	892	597 3274	188 8915
209	289 1366	914 3304	454	426 1455	134 7590	902	600 6663	189 9474
212	291 2044	920 8692	460	428 9522	135 6466	913	604 3178	191 1021
215	293 2576	927 3618	466	431 7407	136 5284	924	607 9474	192 2498
218	295 2965	933 8094	472	434 5112	137 4045	935	611 5554	193 3908
221	297 3214	940 2127	478	437 2642	138 2751	946	615 1423	194 5251
224	299 3326	946 5728	484	440 0000	139 1402	957	618 7083	195 6528
227	301 3304	952 8903	490	442 7189	140 0000	968	622 2540	196 7740
230	303 3150	959 1663	496	445 4211	140 8545	979	625 7795	197 8889
233	305 2868	965 4015	503	448 5532	141 8450	990	629 2853	198 9975
						998	631 8228	199 7999